

*For setting out the Osculating Arcs.*

The distance of the stakes was assumed as 33 feet, or 0·5 chain.

$$\text{Cosec. } \theta = \frac{2 r}{c} = \frac{29\cdot314 \times 2}{\cdot5} = 29\cdot314 \times 4 = 117\cdot256$$

The nearest cosecant was that of 30' (in this case also).

Then, by reversing the formula,

$$c = 2 r \sin. 30' = 58\cdot628 \times \cdot0087625 = \frac{4515 \text{ chain}}{66} \\ = 29\cdot8 \text{ feet}$$

The arcs swept through B and D, being staked out by setting up the theodolite at A.

N.B.—A fresh tangent at any point arrived at on the curve is simply the deflected  $\perp \theta$  from a chord, *i.e.*, from one of the lengths (29·8 ft. in this case), and a subsequent chord is the deflection again of  $\theta$  out of tangent, so that the deflection of chord from chord is  $2 \theta$ . This was shown on the ground, and the whole was understood by several articulated pupils who attended.

ART. XIV.—*On the Resources of Victoria, and their Development.* By WILLIAM E. BRYSON, Esq., C.E.

[Read before the Institute, 5th October and 16th November, 1859.]

YOUR EXCELLENCY, MR. PRESIDENT AND GENTLEMEN—

IN reading this paper before you, I think it necessary to mention that the subject of “Our Resources and their Development” have occupied my attention for a considerable time. It was about the 9th of last July, when the news first reached this colony of war having broken out between France and Austria, that the propriety struck me forcibly of making no longer delay in contributing my mite to incite the inhabitants of this colony to the necessity of increased action in providing for their national wants, by making themselves as far as practicable independent of other countries for articles of agricultural produce, and also for manufactured articles.

I am sorry to say that, at the present time, the perusal of

the details of our exports and imports induces a painful impression that we are doing for ourselves only a little of what we could and ought, considering our capabilities.

On the subject of successfully introducing manufactures among us, I was at first rather sceptical, considering the high rates of labor; but I have not been satisfied with vague surmises, and my researches after facts have put me in possession of many pieces of information, which only require to be acted upon, to considerably enlarge the industrial resources of this colony.

The introduction of manufactures is not the main feature of this particular paper—it will form the subject of another. It is glanced at here, however, because of its great importance, and the firm conviction that we can manufacture many kinds of articles here to compete with those imported; I can with confidence refer to some of the advantages which the introduction of manufactures would confer upon us.

Besides the profits accruing from the establishment of manufactures, the projectors and introducers of such would serve a higher purpose, in the general advancement of the colony. The class of artisans would be increased and encouraged. We should have colonial designs suited to our colonial wants, and these would require colonial designers. The amount of popular intelligence would be elevated, and the now rising generation of Australia, who inherit the mechanical genius and inventive energy of their forefathers, would put the same into practice; while, on the other hand, the production of raw materials alone, which is the present staple of colonial industry, requires very little exercise of intellect, as it is generally carried out with unskilled labor.

Only a few young Australians have now a chance of rising in the world as merchants; and if the rest dislike going into the interior to mine for gold, or to keep sheep or cattle, or are above keeping a butcher's or baker's shop, or drapery, or grocery, or public-house, their only resource is to obtain Government employment, or enter a solicitor's, land agent's, or broker's office—most of which branches of business are overstocked in the colony.

Manufactures would open a healthy outlet for colonial industry, invention, and enterprise for the present and future generations. And while the production of raw materials gives employment to only a few in the lowest order of labor, manufactures would require a division of skilled labor, and diffuse benefits among the general population.

My aim in this paper is to show that an ample field exists here for the further extension of our resources in raw materials, and for the profitable introduction of manufactures whose products can compete successfully with imported articles.

Under ordinary circumstances the balance of trade would be in favor of England, which produces the most value in commodities at the least cost in labor; but in our very peculiar circumstances, situated at the antipodes, though our rates of labor are high, yet the long voyage of about fifteen thousand miles of our raw materials to England, and the similar voyage back to us of those materials as manufactured articles, with the interest of money during these two long voyages, and other detentions, with the double insurances, the many commissions, storages and brokerages, and profits of the various persons concerned—all these amounts, added together, gives a natural protection to the industry of this country. I say a natural protection, not a protection laid on by Government, which will enable us to successfully compete with England and other countries in our own market, by the conversion of many of our own raw materials into manufactured articles.

Let us now consider the effect that would be produced on these colonies by England being engaged in a war with France, or any other nation whose fleet could interfere with our commerce.

At the present time we are dependent for our supplies of almost every manufactured article on England; and many of these imports are our own raw materials returned to us in a manufactured state. These supplies now come to us regularly in ships, several of which arrive here every week. But in time of war all this will be altered. Vessels leaving this colony for England, and taking away our raw materials, such as gold, wool, hides, bark for tanning, will not leave our ports, as they do now, every few days, they will have to wait till a number of them can sail together, and then they will have to sail under the convoy of a ship of war, as they did in the wars of the first Napoleon, when our colonies furnished to England much less valuable articles than gold, wool, and hides. And vessels conveying manufactured articles to us from England, will have to arrive here in our ports after similar long detentions in English ports, till many of them can be got to sail together, and they will be similarly escorted by armed vessels.

Now, the certain consequences of this state of things must be, as all experience has proved—first, the cost of transport from here to England, and from England here, will be enormously increased; and for months together there will be delays in sending our raw materials out of the colony. This will cause a reduced demand, and a fall in their value, which will be a serious loss to the colony; while the manufactured articles only arriving here at uncertain times, and after experience on our part of much inconvenience for want of them in our market, will certainly rise enormously in price. Thus those who now produce and export raw materials to England will suffer greatly from depreciation in value of such articles; while every one in the colony, without any exception whatever, will suffer from the enhanced value of all manufactured articles imported. This depreciation alone in the value of our raw materials, will cause many persons to be thrown out of employment; and thus, when manufactured articles are much dearer, there will be less means to purchase them. These disadvantages will tell upon us most seriously in war times, as long as we are not a manufacturing people.

Looking at the list of articles we import, there are no importations which are so fatal to our interests as are the introduction of wheat, flour, oats, barley, malt, maize, and gram. We import these from countries, for the most part, which have no manufactures, and we pay for them invariably in ready money. All these articles we could raise ourselves, and we ought to raise them; if we did, then the one and a half millions of money which we pay for them would go into the pockets of our Victorian farmers, instead of into the pockets of the farmers of other countries. And therefore so much more money would be in circulation among us, for the encouragement of colonial enterprise and industry.

I say, in time of peace that the importation of these things is bad for us; but in time of war dependence on such importations must reduce us to great straits, and panics, and severe loss, and possibly even to plague and famine.

There is no commodity on which scarcity or precarious supply has such an effect as on the price of corn. An eminent writer says—“In the case of deficient supply, every one aiming to get what he requires, produces a disproportionate advance in price. Thus, a deficiency of one-tenth of the quantity of corn required, will raise the price three-tenths beyond the usual rate. And a deficiency of one-fourth, more

than doubles the price of the article. And even in England, the price of corn in a short time has fluctuated to 200 per cent. advance." But we can easily see what monopolies of dealers there would be in this colony, and what panics, well fed as we are now used to be, if such fluctuations in the price of breadstuffs ever take place here, in conjunction with depreciation in the value of our raw materials, and a heavy rise in the price of manufactured articles, how deplorable will be the condition of half the people of this colony.

I have now to direct your attention to our importations of wheat, flour, oats, malt, maize, and gram, and shall mention how much these articles cost us in the year 1858.

In that year we consumed 75,000 tons of flour; and of this quantity we imported 31,000 tons (25,000 tons of this came to us as flour ready milled, and 6,000 tons of it came as wheat, which we ground into flour); and for these 31,000 tons of imported grain we paid £600,000. The greater part of this flour came from Adelaide and Tasmania. Now, if the Adelaide and Tasmanian people can afford to ship their flour here, with all the heavy expenses attendant thereon, we ourselves ought to be able to raise it at a considerable profit; and our farmers do seem to be getting into a knowledge of this, for whereas there were only 13,000 acres of land under wheat in 1854, there were 87,000 acres under wheat in 1858—that is, about seven times the quantity; and if we found it worth while to raise 41,000 tons of flour, why not raise the 31,000 additional tons required, and which were imported?

As to oats, in 1858, we imported one and three quarters millions of bushels, at a cost of £530,000; and yet we raised in the colony £420,000 worth, or one and a quarter millions of bushels—that is, we raised nearly as much oats as we imported. But we might as readily have pocketed the additional £530,000 we paid away.

In the case of barley, in 1858 we produced 157,000 bushels, worth about £33,000; and we imported 122,000 bushels, at a cost of about £26,000. Now, barley is a grain which comes to perfection in the greatest variety of climates, and is, consequently, found over the greatest extent of the civilised globe; it bears the heat and drought of the tropics, and ripens at the torrid zone. There is, I believe, actually a strong prejudice against the raising of this grain in Victoria, which is a great misfortune; for barley is better suited to Victoria than, perhaps, any other grain. If sown at the proper time it is not affected by the hot winds. It is admirably adapted for

horse-feed, as horses prefer it to hay, which, in Victoria, often rises to enormous prices. It is most extensively cultivated in New South Wales, and is considered a most remunerative crop. In Spain two crops are reaped in one year—one in spring, from seed sown the preceding autumn, and one in autumn, from seed sown in spring. The practice of sowing clover or ryegrass with the barley should be universal, as it is considered one of the great modern improvements in agriculture.

Now, what I have just said refers to the desirability of our raising barley extensively, to do away with the necessity of our importing it as horsefeed. A far more important use of barley yet remains to be considered. Malt is barley converted into the material for brewing. And of malt we did not make 50 bushels in 1858; and we imported the large quantity of 215,000 bushels, worth, at 11s. the bushel, £118,000. In the case of malt we made no effort to help ourselves, yet the malt which comes to us from England is deteriorated by the long sea voyage. One would almost suppose that two-thirds of our farmers did not know that malt was simply barley or other grain which has been steeped in water till it swells, then is laid on floors till it heats and germinates, at which period it has attained its maximum of sweetness, and then it is kiln-dried. Now, all these are simple operations (in fact, malting is considered as a change of the starch of grain into sugar, preparatory to a further change into spirit). There is rather a fine field here for our farmers. We should raise annually 350,000 more bushels of barley than we do, principally for conversion into malt.

In the case of maize, though our climate is admirably adapted to grow this valuable grain, yet last year we raised only 7,000 bushels; and we imported, to our shame be it said, the large quantity of 150,000 bushels, for which we paid away in ready money £52,000. Nearly all this imported maize came from New South Wales, a gold colony like our own. This fact speaks volumes on our inertness in taking advantage of our colonial resources.

Of gram we imported in 1858 a quantity worth £37,000; and this is a grain that grows to perfection in Victoria, and only requires to be better known to come into universal request as an economical horse food.

Thus, in the year 1858, a year in which there was great distress in this colony among the laboring classes, we actually sent away for the above five descriptions of grain the following sums, viz. :—

For wheat and flour .. .. .	£600,000
For oats .. .. .	530,000
For barley, and malt made from barley. .	144,000
For maize, imported principally from New South Wales .. .. .	52,000
For gram .. .. .	37,000
	<hr/>
	£1,363,000

That is, for the above five articles alone, our colonial farmers in this colony of Victoria kept out of their pockets nearly one and a half millions of money in the year 1858 (and this list does not include hops, potatoes, vegetables, &c., nor many other items of agricultural produce, as the total amount of agricultural produce imported last year into this colony cost £3,000,000 of money).

Let us hope that our farmers will now bestir themselves, especially as, in the opinion of many, we are on the verge of a war which may make us almost wholly dependent on our own resources; and it is proper to be mentioned that if our imports for the remainder of this year continue in the proportion they have for the last seven months, all our imports for this year will exceed all our exports by more than two millions of money.

In treating on agricultural produce, I will continue on a little longer in connection with other wants than our own. In England great attention is paid to the fattening of cattle, and among such great beefeaters as we are, to provide a sufficiency of food for the sustenance of our cattle is a subject of great importance, especially as for many months in the year our natural pastures are burnt up. Linseed cake is most extensively used for this purpose in England. Now linseed, or the flax plant, grows here very well. The oil is easily expressed from it quite cold; and we import about 300,000 gallons of the oil yearly for the use of painters and other purposes, worth about £70,000. Were we to grow this plant, we could not only save this £70,000 which the oil costs us, but we could provide about 60,000 tons of oil cake for cattle feed. The oil would yield a profit, and the oil cake would be had for nothing. 60,000 tons of oil cake would be worth £500,000 at the least.

Speaking of cattle-feed, I will also mention the sunflower. This is a most prolific plant. One acre bears from thirty to forty bushels of seed; each bushel yields one gallon of oil,

worth 6s., which sells readily in the market; the refuse after the oil is extracted is the oil cake, at the rate of 12 to 15 cwt. per acre, for the feed of cattle, poultry, &c. The sunflower derives its nourishment, in great measure, from the air, and exhausts the soil very little. In this case also there is much cattle-feed per acre for a trifling expense.

Both in England and France, within the last two or three years, beetroot has assumed new importance, both for the fattening of cattle and for the purposes of distillation. This root has been always famed for its fattening properties as cattle-feed. Until very lately many plans of distilling this root have been adopted, in France and England; but all of them, though they produced a satisfactory amount of alcohol, left a residue of little value for cattle feeding purposes, until a new method was discovered by a French distiller. This system is simple, and is as follows. The beetroot is cut by a common root-cutter into thin slices. These are put into fermenting vats, with a little acid and some yeast and water, by which they are brought into a high state of fermentation. After this the slices are placed in layers on perforated plates, in iron cylinders; and steam is introduced into the bottom of the cylinders, which steam passes through the perforated plates and boils the beetroot; the vapor is then received and condensed in worms, and is a spirit twenty per cent. over proof, resembling whisky. In France, in the year 1857, two and a half millions sterling of this spirit was distilled, showing its value. But, best of all, the residue is so useful for cattle food, that eighty per cent. of the nutritive matter remains after distillation; and this residue, after distillation, is not affected by heat or cold, and may be kept for an indefinite time. Some of it, after lying two years in an open tank, has been eaten with avidity by sheep and oxen; and, mixed with chaff, it is their favorite food all the summer. Thus, two tons of beetroot yield thirty-two gallons of excellent spirit, equalling the best whisky, and leaves one ton of pulp, which is equal in nutrition to 32 cwt. of the original root, for cattle-feed. When it is remembered that we import beverages yearly to the amount of two and a half millions sterling, the importance of colonial distillation will be more fully appreciated.

Before leaving the subject of cattle-feed, I would refer to the sorghum millet, or Chinese sugar cane. Most of the varieties of the sugar cane flourish in Victoria. To show the hardiness of this plant, it may be mentioned that in the most



northerly of the States of North America it grows to a height of fourteen feet ; and, while maize and other grain is killed by frost alongside, the sugar cane remains uninjured. For cattle-feed its nutritious powers, compared with hay, is as three to one. Two crops of fodder can be grown in a season from the same roots, irrespective of drought. In fact, as green food for cattle, it is unrivalled, as it produces at the rate of seven tons to the acre green, or two tons to the acre cured.

I do not refer to the sorghum cane here with reference to its saccharine qualities for the manufacture of sugar, or for distillation, but simply for its advantages for animal fattening, it being freely eaten either in a green or dried state, by horses, cattle, sheep, and swine. And the sorghum flourishes during the summer season, when our natural pasture is suffering much from drought.

As I have spoken of the linseed and sunflower plants in connection with the production of oil, as well as cattle-feed, I would now continue the subject, by referring to the suitability of our soil and climate for the growth of the olive tree. Olive oil, we all know, is much in request ; and the production of oil from the fruit of these trees is very easy. The fruit is allowed to drop, which is preferred to beating it from the trees, and would be better for us, as involving less labor. The olives are collected in heaps, and taken to a mill, where they undergo three distinct pressings or crushings. The oil from the first pressing is the best ; that from the next is inferior ; and the last yields an oil inferior still. A couple of men are able to express a fabulous number of gallons per day. This is a business, I need not say, we have not yet gone into ; but it would be desirable for our farmers to see the importance of growing the olive tree in plantations. These, after a few years, would be most remunerative.

There are few in this colony who do not know the castor-oil plant, but there not many who know its value. For the first two years of its growth it is rather handsome ; but its beauty soon departs, and it is looked upon as an unsightly cumberer of the ground, whereas in reality it is the more valuable the older it is until it arrives at maturity. It is a hardy perennial, and grows on year after year without re-sowing. It is valuable principally for its oil, worth 10s. a gallon. This oil is the only oil used for locomotive engines, and for the journals of machinery. One locomotive engine requires about ten pints a week, and other machinery in pro-

portion. The consumption of this oil will increase rapidly, and for many years to come it may be expected it will be required in larger quantities.

The next subject I would mention is the culture of the grape. As I wish to bring original ideas only before the Institute, and to tread in no man's footsteps, at first I felt tempted to pass over the grape; but I feel its importance too strongly to do so. My convictions on this subject are strong; and I think that if they have been considered benefactors of mankind who have made two blades of grass to grow for one that grew before, so I should consider every Victorian a benefactor to his country who either plants a few vines himself or induces his neighbors to do so.

An acre of vines produces 10,000 lbs. of grapes; 15 lbs. of grapes make one gallon of wine. The first cost of an acre of grapes is as follows:—

Under disadvantageous circumstance, trenching and clearing .. .. .	£40
3,000 plants, at £2 a thousand, is.. .. .	6
Thirty days setting these 3,000 plants is.. .. .	16
Post and rail fence, per acre .. .. .	50
Labor and management, and interest of money for three years .. .. .	130
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Total for one acre .. .. .	£242

After three years this vineyard will produce 400 gallons of wine, worth from £150 to £200; and at least one and a half tons of grapes worth £30, at less than 2d. per pound.

In the fourth year this vineyard will produce 700 gallons of wine, worth at the least £300, and two tons of grapes worth, at 2d. a pound, about £38; making £338 per acre at the least: and every year after this the yield will increase. Thus, a good vineyard, if it contains good vines, in a good situation, may be fairly expected to yield £340 per year per acre. As much as 1,400 gallons of good wine have been produced in this colony from one acre of grapes, which was worth £700, in the parish of Barrabool, near Geelong.

I may as well mention here that the application of sulphur to the roots of the vines is a certain cure for the blight, to which vines are occasionally subject; and a large reward has been paid by the French Government to the discoverer. Still there are difficulties in determining when the plants should

be sulphured, that being dependent on the soil, the temperature, and the variety of grapes.

In the process of wine-making, the grapes which get saturated with wet are only fit to make brandy. But as there is a revenue derived from the import of French brandies, the colonist is practically prohibited from making brandy for sale from his own vineyard, lest he should interfere with the importations from France. Thus we annually put £180,000 at least into the pockets of Frenchmen, which our own vine-growers might transfer to their own. We have had lately, in the daily papers, an instance of an insolvent who stated that his insolvency had arisen from his being disallowed to rectify some simple kind of spirit, after he had gone to great expense in procuring the necessary plant and materials.

But this subject of wine and brandies is only part of what the culture of the grape leads us into.

Why should we not produce raisins and dried currants, such as we now import so largely? England imports from Spain and Turkey annually 20,000 tons of raisins, worth £800,000, exclusive of the duty of £15 a ton; and we in this colony import of raisins about 300 tons annually, worth about £35,000. For my part I do not see why we might not annually export 5,000 tons of raisins to England, as well as meet our own requirements. 5,000 tons of raisins exported would be worth at least £180,000; and, with the £30,000 which we pay for raisins here, would be £210,000 into the pockets of our Victorian vine-growers; and if our Victorians were pocketing this amount every year, it would still leave 15,000 tons of raisins to be imported into England, from Spain and Turkey; so that we need not be afraid of being considered selfish. This curing of raisins is a simple affair; and the quality of raisins depends more on the method of cure than anything else. The finest raisins are cured in two methods—either by cutting the stalks of the bunches half through when the grapes are nearly ripe, and leaving them suspended on the vines till the watery part has evaporated, and the sun dries and candies them; or by gathering the grapes when they are fully ripe, and dipping them in a ley made of the ashes of the burnt tendrils, after which they are exposed to the sun to dry; those cured in the first way being most esteemed, and being called raisins of the sun.

We might also do a large trade in what are called grocers' currants. These are not real currants, but a kind of very small black grape, which is even now cultivated to a small

extent in this colony. I have had a receipt for the preparation of these currants for many years, which is as follows :— Preserve your vine-cuttings till the vines ripen, then make charcoal of these vine-cuttings ; mix one quart of charcoal to four quarts of water, dip your currants (placed in a sieve) three times in this ; then expose them to the sun. These precautions are most necessary, for if the weather is bad the drying process takes a fortnight, and a thunderstorm will often completely spoil the fruit.

Of tobacco I need not say that it is a most important article of consumption. Nor need I say how admirably the climate and soil of Victoria is suited to the growth of this plant. A general idea prevails that tobacco requires a tropical climate. This is a great mistake ; as it grows to perfection both in England and Ireland ; and its growth is prohibited there only because imported tobacco yields the tremendous revenue of five millions per annum, which revenue in the home-grown tobacco it would be impossible to collect. I believe we annually pay away about £200,000 a-year for imported tobacco. Now the only objections that have ever been urged against Victorian-grown tobacco are, that it is not quite so strong as the imported, and has a slightly peculiar taste. These objections, I am persuaded, could be removed, by preparing the tobacco in the same way as in the countries where our best tobacco comes from. And this method of preparation is very different indeed from any method that has been adopted here. The plan of preparation is as follows :—The tobacco is cut and taken to a shed affording a free circulation of air. It is then placed on poles laid horizontally, at a height of a few feet over the surface of the ground, where it dries, and when hot weather comes on it swells, which gives it a silky appearance. The tobacco is then laid into heaps, and sprinkled with water, when it ferments. Some refuse leaves are then infused in water or very weak wine, and this infusion undergoes a species of fermentation, after which the refuse leaves fall to the bottom of the vessel. All the tobacco is then dipped into this fermented infusion, and hung up to dry in a room almost airtight, when it begins again to sweat, which process is called the *calentura*, or fever. And this process of dipping is repeated as often as the tobacco requires it. Now let it be generally known that, on an average, in the best tobacco-raising country only one good crop may be expected in three years ; and, in any case, all the tobacco will not be of the

same quality; only a small portion will be of the best description, and the remainder will be of different degrees of excellence. The knowledge of this would deter many from being discouraged who are now completely disheartened by the failure of their first efforts; and the dipping process, I am convinced, is absolutely necessary for the manufacture of a strong tobacco.

The next subject I would direct your attention to is our wool trade. England at present annually imports over one hundred millions of pounds of wool; and about half of this quantity, or nearly fifty millions of pounds, comes from this and the neighboring colonies. The rest is supplied by Germany and Spain, by the south of Africa, the south of Asia, and the south of America. The wool trade of these colonies is the growth of only thirty years; as in 1830 the colonies only exported three millions of pounds. The colonies should certainly produce all the wool England requires; and if we Victorians did our part, we could annually export to England £900,000 sterling worth more of wool than we do. Two millions sterling a-year is lost to these colonies in the wool trade, which two millions goes into the pockets of aliens. Seeing the rapid strides which our wool trade has made in thirty years, I doubt not that ultimately the export of wool from Australasia will equal one hundred millions of pounds avoirdupois. But I think this result ought to be brought about in the shortest time possible.

In this place I would remind you that at this advanced age of the world's history means are employed whereby, in agriculture, as in other vocations, the mere cost of labor is a small item; and it has been predicted, and I think will be fulfilled, that all harvest operations on land properly laid down will shortly be performed in one-fourth the time now occupied in hand labor. The truth is now beginning to be duly appreciated, that sound theory in physical science consists simply of facts, and the deductions of common sense from them reduced to a system. I would refer you to an article headed "Steam, and its Advantages to Agriculture," which appeared in *Bear's Weekly Circular* of Saturday, September 3rd, 1859. That article should be read and studied by every agriculturist in the colony. Horse-power is twice as dear as steam, where the latter can be employed; and on every farm of 150 acres, or less, there ought to be a six-horse power engine to grind corn, crush oats, break rape cake, cut and steam chaff, thrash and dress corn, work pumps, saw timber, and cultivate the

soil, and perform the harvesting. Be it remembered, on a farm of 150 acres there ought to be 150 tons of straw to be cut into chaff, and to be steamed from the waste steam of the engine. And the following are some of the operations, such a machine as above will accomplish under competent management:—Cut hay into chaff, roots cut for sheep, roots cut for bullocks, roots pulped, thick oil cake broken, wheat and barley thrashed and dressed.

Every hundred acres of arable land requires, according to the present system, about five horses, and these consume an enormous amount of the produce of the land; and we know that time is money in agriculture as in every other industrial occupation. I would refer these matters to your serious consideration, convinced as I am that a more general use of steam engines in agricultural operations, with our natural advantages of climate and soil, would take away the shadow of an excuse from us for squandering in this colony of Victoria the large amount of over three millions annually, in importation of agricultural produce, which we can and ought to raise for ourselves.

In the matter of drugs and chemicals a good deal could be done in the colony of Victoria—sarsaparilla, for instance; large quantities of this are imported into this colony from America and Great Britain. Now this root is indigenous to many of our mountainous districts, equal to the red sarsaparilla of Jamaica, which is considered the best.

Saffron can be produced most abundantly in the colony; also rhubarb, equal to Turkey; with sassafras, quassia, and such dyes as logwood, brazil wood, and sumach. Of this last dyestuff, I may as well mention that the very large quantity of 80,000 tons are annually imported into England. It grows in Spain, Portugal, and Italy. The sumach tree, or rather shrub, grows to a height of about eight or ten feet; the stems are ligneous, the bark is hairy and brown in color. The shoots of the shrub are cut down every year close to the roots, and after being dried are reduced to powder in a mill.

As to the numerous gums and resins of Australia, they have been so carefully enumerated and described in a paper read before this Institute in September, 1856, that I need only refer to it on this subject. Opium and anodynes, such as laudanum and morphine, could be manufactured here. The opium poppy grows well, and by macerating and boiling the capsules in water, and evaporating the decoction down to

a paste, a large quantity of extract is obtained. The seeds are not medicinal, but are fattening food for fowls.

But there are many reasons why we the colonists of Victoria should not confine our exertions to Victoria. Victoria is the leading colony of Australia, and a very large proportion of the capital and enterprise of this continent are possessed by us. Now there are some articles which might become great staples of Australasian trade, which the climates of New South Wales and Moreton Bay only would produce. I refer more particularly to cotton and indigo. From time to time enterprising individuals have imported small quantities of cotton seed from America; and cotton, as you all know, I doubt not, of most excellent quality has been produced by white labour along from 500 to 700 miles of the Australasian coast to the north of Sydney, water carriage being everywhere available. To England, of course, the cotton would be sent; but our distance from England is not a great obstacle, as our freights for wool are only about  $\frac{1}{4}$ d. to  $\frac{1}{2}$ d. per lb., and cotton is easier packed. While cotton from New Orleans to Liverpool costs  $\frac{3}{4}$ d. per lb., and though the American cotton is raised by slave labour, I am convinced Australian-grown cotton could compete in the English market with it. Our wool has competed many years in the English market with wool grown in the cheap countries of Spain, France and Germany; and though within the last few years the rates of wages here on account of the gold discoveries have been more than doubled, yet our wool competes now even as successfully with the wool of the cheap countries as before; and if this is an eloquent fact in regard to wool, it would be equally so with regard to cotton, in all probability; and the mere cost of labour on an article worth 2s. per lb. would prove insignificant. It is a well known fact that slave labour is not economical, the labour of a white man being always reckoned as worth the labour of several slaves, besides the fact that appliances in the slave states are generally of the rudest kind.

In many respects the example of the United States will be instructive to us. Sixty years ago their population was only three millions; they have now a population of twenty-six millions, and now they manufacture nearly everything they require.

In the cycle of human affairs events often repeat themselves; and the rapid increase of population and manufactures in America may be equalled by a corresponding increase with

us. But even at the present day, though America is within such a short distance of the cheap labour countries of Europe, yet the rates of labour in all parts of America are double what they are in England, yet America finds it profitable to manufacture for herself. Nearly all her manufactories are in the northern states, where there is no slave labour, and where the rates of wages are highest. But after all, where machinery and subdivision of labour are carried out practically, the mere item of dear manual labour is an inconsiderable one, as a set-off against the expenses of long voyages, interest of money, insurance, and many profits.

As many opinions are entertained on the value of our gold deposits, I cannot but glance at the question.

Gold and silver, as mediums of exchange, act as a stimulus to industry and invention; without these two metals we should have to fall back on the obsolete system of barter. These metals also exercise a most decided influence on the distribution of wealth, for having a certain relative value to each other, we can offer much or little of these metals in exchange for what we want, according to the value of the articles; and our mode of payment will be acceptable all over the earth, no matter what may be the race of our customers, or their language or habits.

Looking upon gold and silver in the light of permanently acceptable mediums of exchange, has opened up speculations as to whether these two metals will continue to bear the same relative value to each other as they do now. This must depend on the quantities of each commercially available, and on the quantities commercially required. This subject requires breadth of treatment, and speculations founded on the present limited commerce of the world cannot grapple with it. As human beings become civilised, so do their wants increase, and the imports and exports of all communities are less or more, exactly in proportion to their industry and intelligence. Africa has no gold-coined money, with near two hundred millions of barbarous inhabitants, most of whom in their uneducated condition, like the inhabitants of ancient Nineveh, do not know their right hands from their left. Asia has six hundred millions of pagan inhabitants, and even in India and China, at this advanced period of the world's history, gold is not used as coined money, but is bought and sold exactly as pearls, diamonds, and precious stones, for personal ornamentation and barbarous display; and where gold is not used to perform the functions of money, it has



proved of less real value when exchanged for other commodities.

But even the civilisation of the greater part of Europe and America is very imperfect, when compared with that of England; and consequently as their trading transactions are limited, so their gold currency is limited also.

But give any of the most barbarous inhabitants just enumerated, amounting to hundreds of millions, give any one of them mental culture, and bring him up under such advanced human institutions as we are privileged to possess, each one, excepting those mentally and physically imbecile, is fitted by nature to long for and enjoy the thousand etceteras of civilised life with as much zest as any member of this Institute; and these etceteras are not to be obtained by individuals and communities without gold and silver as circulating mediums.

Gold is coming into use more extensively every day for the purposes of gilding and jewellery. It is an undoubted fact, that within the last ten years jewellers have increased two and three fold. The sale of gold watches has increased enormously; and if every one of the twelve hundred millions of inhabitants in the world had but one single article of jewellery each to supply them, it would nearly use up all the gold we possess; while of these, few of the softer sex, if they could manage it, would be satisfied with less than a pair of gold earrings, gold necklace, gold watch, gold chain, gold rings, gold bracelets, gold brooches, and gold pins, while much gold is lost yearly by friction, and large quantities in gilding.

The use of tea brought silver spoons into fashion, and only a few years ago we had no silver forks; but the silver now manufactured into teaspoons and forks amounts to many tons annually. And thus new inventions may multiply the uses of gold. But be this as it may, should Victoria, and New South Wales, and California, and Russia furnish every year for the next hundred years as much gold as is now annually produced by them, I believe it would be all absorbed into the general circulation of the world without any depreciation in its value. And even now in this colony of Victoria gold is being purchased in large quantities to send into China; but the wants of China are now small compared with what they will be.

In concluding this paper I would remark that the chances and changes which may take place in the world within a short time are incalculable. The annexation of a good part of

China to our Asiatic empire is not an improbability. The history of the world for the last 360 years is most instructive on the subject of great territorial changes. 360 years ago all of our globe which was then known was Europe, Asia, and Africa. 360 years ago Columbus discovered America, and since that time this continent of Australia has become known. Europe, Asia, and Africa contain about thirty millions of square miles, and America and Australia about twenty millions of square miles; thus within 360 years the known earth has been nearly doubled in extent.

But to come nearer to our time, the history of the world for the last 103 years is more surprising still. In the year 1756 British soldiers fought and gained the first great battle of India, by which England gained the province of Bengal, and the base of our present gigantic Indian empire. And in the year 1759, three years later, and only 100 years ago, British soldiers nobly fought and gained the equally great and eventful battle of Quebec, by which England gained possession of the greater part of North America; also within 100 years we have become possessed of this great continent of Australia. Thus within about 100 years our British empire has increased to forty times its former extent; and in the same time Russia has increased over fifty times.

When we turn our attention to the events which have taken place, we are struck with the definiteness of their leading features, and their suitability as an introduction to the succeeding states of human progress. And I cannot but look on the discoveries of gold within the last twelve years in large quantities, first in California, which is on the west coast of the Pacific, next on this, which may be called by distinction the great Australasian Continent of the Pacific; and still later, in Oregon, Vancouver's Island, and Frazer's River, all on the west coast of the Pacific, and all these countries bordering or in the Pacific. With the immense emigration which is induced to these places, all of which are in the possession of people of British descent, I say I cannot but look on all these as indicative of a design manifested on the part of the Ruler of the universe to found a series of new Pacific empires—Pacific in more than name, where liberal institutions, suited to this advanced period of the world's history, shall be planted down all at once in the Pacific, to exercise ameliorating influence on the surrounding barbarous and semi-civilized people of Asia and Africa, and the west coast of South America, which contain a large part of the

population of the globe; and to exercise their just sway in scenes unpolluted by the many sad acts of human selfishness, perfidy, despotic dominion, and carnage of the older portions of the world.

This colony of Victoria will be added to the list of unexampled strides made in the last half century, and will yet be spoken of in connection with steam-power, gas, a hundred-fold increased manufacturing capabilities, electricity, photography, and the many other additions to human advantages, which are the distinguishing characteristics of our age and nation.

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ART. XV.—*Notes on the Cheilostomatous Polyzoa of Victoria and other parts of Australia.* By P. H. MACGILLIVRAY, A.M., M.R.C.S.

[With a Plate.]

[Read before the Institute Oct. 26th, 1859.]

HAVING had opportunities of examining a considerable number of Polyzoa from our own colony and several other parts of Australia, I am induced to present to the Institute a complete catalogue of the species of the Cheilostomatous sub-order which have hitherto come under my observation. A large proportion of them have already been described, but several are new to science, and some previously known are now for the first time recorded as Australian. I would particularly call the attention of any members who may study this class to the fact that little is known of the structure of the animals in the genera most characteristic of the southern seas, and that the details of the anatomy of *Catenicella* especially would be of high scientific interest. I would also recommend a careful examination of the Membraniporidæ, which, although extremely abundant in other parts of the world, seem to have almost escaped the notice of naturalists in Australia, and of which I believe that a diligent search would add many species to our fauna. In other genera also a large accession to the already extensive list may be confidently anticipated.

The arrangement adopted is that given by Mr. Busk, in his admirable British Museum Catalogue.

I would here beg to express my thanks to those friends who have kindly aided me by the contribution of specimens,